Customer No.: 31561
Docket No.: 12627-US-PA
Application No.: 10/709,282

In The Specification:

Please amend following paragraphs:

[0003] The present invention relates to an AC/DC converter with piezo transformer, and more particularly, to a single stage AC/DC converter with piezo transformer.

[0005] In order to reduce the usage of the chemical materials, an AC/DC converter is commonly provided in the electrical apparatus which uses DC power such as battery as its operating power, such that the electrical apparatus can use the AC power provided by the power company as its operating power. In general, the AC/DC converter converts an AC power into a DC power by using an electric-magnetic converter, and the piezoelectric transformer is an electric-magnetic, which is most commonly used in the AC/DC converter now.

[0006] The piezo transformer is made of a ceramic material, and its energy is transmitted by the mechanical vibrations, thus it is characterized by smaller size, non-burnable, and high electric insulation. For the back light of the color LCD, the piezo transformer is an optimum power source. However, currently the developers are unable to propose a new method for making good use of the piezo transformer. As shown in FIG. 1, a half-bridge circuit 160 is commonly used as a part of the driving circuit in the AC/DC converter 15 with piezo transformer 150.

[0007] In the light of the preface, the present invention is directed to a single stage AC/DC converter with piezo transformer. A new architecture of using the piezo

transformer is provided by combining the bulk circuit and the half-bridge circuit together.

[0008] The present invention is also related to a single stage AC/DC converter with piezo transformer, in which a simple circuit is used to replace the half-bridge circuit of a common AC/DC converter with piezo transformer.

[0009] According to an embodiment of the present invention, a single stage AC/DC converter with piezo transformer suitable for converting AC power into DC power is provided. The single stage AC/DC converter comprises a rectification module, a switching module, a driving module, a piezo transformer and an output rectification module. Wherein, the rectification module comprises a pair of rectification input terminals, a first rectification output terminal and a second rectification output terminal. The pair of rectification input terminals receives an AC power and coverts the AC power into a rectification output signal, which is then propagated to the first rectification output terminal. The switching module comprises a bulk circuit, a half-bridge circuit, a first switching diode, and a second switching diode. The bulk circuit comprises a bulk input terminal, a first bulk output terminal, and a second bulk output terminal. The bulk input terminal electrically couples to the first rectification output terminal mentioned above for receiving the rectification output signal, and a bulk signal is generated from the first bulk output terminal after the rectification output signal is processed by the bulk circuit. The half-bridge circuit comprises a first half-bridge input terminal, a second half-bridge input terminal, and a half-bridge output terminal. The first half-bridge input terminal electrically couples to the first bulk output terminal mentioned above, and the second half-bridge input terminal electrically couples to the second rectification output terminal

mentioned above. An anode electrode of the first switching diode electrically couples to the second half-bridge input terminal, and a cathode electrode electrically couples to the second bulk output terminal. An anode electrode of the second switching diode electrically couples to the second bulk output terminal, and a cathode electrode electrically couples to the half-bridge output terminal. The driving module electrically coupled to the second bulk output terminal and the half-bridge output terminal of the switching module motioned above blocks the DC bias which is output from the half-bridge output terminal, and generates a driving signal after the signal obtained from blocking the DC bias is resonated. The piezo transformer generates a corresponding piezo transforming signal according to the driving signal. The output rectification module comprises a rectification circuit and an output load. The rectification circuit rectifies the piezo transforming signal and generates a DC power on both terminals of the output load.

[0011] The present invention further provides a single stage AC/DC converter with piezo transformer suitable for converting AC power into DC power. The single stage AC/DC converter comprises a rectification module, a switching module, a driving module, a piezo transformer and an output rectification module. Wherein, the rectification module comprises a pair of rectification input terminals, a first rectification output terminal, and a second rectification output terminal. The pair of rectification input terminals receives an AC power and coverts the AC power into a rectification output signal which is then propagated to the first rectification output terminal. The switching module comprises a bulk circuit, a half-bridge capacitor and a half-bridge circuit. The

bulk circuit comprises a bulk input terminal and a bulk output terminal. The bulk input terminal receives the rectification output signal, processes the rectification output signal with its bulk circuit, and generates and propagates a bulk signal to the bulk output terminal. The half-bridge circuit comprises a first switch, a second switch, and a half-bridge output terminal. One terminal of the first switch electrically couples to one terminal of the half-bridge capacitor, and the other terminal of the first switch electrically couples to one terminal of the second switch., the half-bridge output terminal, and the bulk output terminal. The other terminal of the second switch electrically couples to the other terminal of the half-bridge capacitor and the second rectification output terminal. The driving module electrically coupled to the half-bridge output terminal and the second rectification output terminal blocks the DC bias which is output from the half-bridge output terminal, and generates a driving signal after the signal obtained from blocking the DC bias is resonated. The piezo transformer generates a corresponding piezo transforming signal according to the driving signal. The output rectification module comprises a rectification circuit and an output load. The rectification circuit rectifies the piezo transforming signal and generates a DC power on both terminals of the output load.

[0013] The present invention provides a simple circuit to operate the A/D converter with piezo transformer by combining the bulk circuit and the half-bridge circuit together. In addition, the new circuit configuration is totally different from the currently used circuit configuration, thus the present invention provides a new direction to the circuit designers, such that the circuit designed are stimulated to improve the circuit design.

[0015] FIG. 1 is a schematic circuit diagram of a conventional AC/DC converter with piezo transformer.

[0016] FIG. 2 is a schematic circuit diagram of a single stage AC/DC converter with piezo transformer according to an embodiment of the present invention.

[0024] FIG. 9 is a schematic circuit diagram of a single stage AC/DC converter with piezo transformer according to another embodiment of the present invention.

[0027] FIG. 2 is a schematic circuit diagram of a single stage AC/DC converter with piezo transformer according to an embodiment of the present invention. In the present embodiment, the single stage AC/DC converter 20 comprises a rectification module 200, a switching module 210, a driving module 220, a piezo transformer 230 and an output rectification module 240. In normal operation, the single stage AC/DC converter 20 is connected the rectification module 200 to an AC power V_I, and an internal circuit of the single stage AC/DC converter 20 is used to convert the AC power V_I into a DC power V_O for providing power to the electrical apparatus connected to it.

[0045] In addition to the embodiments mentioned above, the present invention further provides a single stage AC/DC converter which combines the bulk circuit and the half-bridge circuit together. Referring to FIG. 9, it schematically shows a circuit diagram of a single stage AC/DC converter with piezo transformer according to another embodiment of the present invention. In the present embodiment, most components constituting the single stage AC/DC converter 90 and its connection are the same as the circuits shown in FIG. 3A, 3B and 7~8 except for the implementation of the switching module 900. Therefore, the detail circuit of the switching module is described

hereinafter, whereas other circuits will be omitted.

[0048] Accordingly, the aforementioned circuits allows the integration of the bulk circuit and the half-bridge circuit into a single stage switching module. Accordingly, a simple circuit can be used to operate the single stage AC/DC converter with piezo transformer.